The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LII
No. 1336

SATURDAY, FEBRUARY 3, 1945
REGISTERED AS A NEWSPAPER

6D. PER COPY
POST FREE 8D.

Metallurgical Section

Published the first Saturday in the month

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February 3, 1945

Indian Aluminium

Rolling Mills and Reduction Works Completed

(From a Special Correspondent)

IN view of the attention which has lately been paid to the progress of India towards industrial self-sufficiency, the following details concerning the production of aluminium in that country are of special interest. As will be seen, the Indian Aluminium Company, Ltd., of Calcutta, formerly the Aluminium Production Company of India, has been making excellent progress under the adverse conditions of war, and has laid a foundation which augurs well for the future.

The company's rolling mills, located near Calcutta, were under construction at the outbreak of war. Equipment for these mills was on order in England, and completion was delayed because this equipment was released for installation in factories in England, so that it had to be re-ordered and subsequently obtained from Canada and the United States. However, these mills, for the rolling of aluminium sheet, were brought into operation in August, 1941, and have since been in full production. Equipment is up to the latest Canadian and British standards, and consists of reverberatory coke-fired melting furnaces, 65 in. hot mill, 65 in. flat sheet mill train with roughing and finishing stands, strip roughing and finishing mills, electric preheating and annealing furnaces, and automatic shearing, slitting, and circling equipment. The works are equipped with a complete chemical laboratory and physical testing equipment. Construction of a metallurgical laboratory is now proceeding, and this will include a Vickers projection microscope and other equipment for metallographic research. The mills are being expanded for the production of strong alloy sheet, and a Birlec heat-treatment and anodising plant is being installed.

Hydro-Electric Power

The reduction works, near Alwaye, in Travancore State, South India, came into production in March, 1943, since when they have been in continuous and commercial production of virgin aluminium. Power is supplied from the Travancore State Hydro-Electric Scheme, and converted by means of mercury arc rectifiers. The works comprise transformer yard, rectifier station, reduction furnace buildings, electrode plant, and auxiliary buildings, and follow the latest Canadian smelter practice. They are designed for an output of 5000 tons per annum, and expansion of output is taking place concurrently with the expansion of the hydro-electric scheme that is now taking place. An up-to-date and well-equipped laboratory has been installed for control of metal purity and raw materials, and also a laboratory for control of electrode manufacture and raw materials.

Use of Native Bauxite

In view of the paramount necessity for the production of metal by the earliest possible date, the reduction works began operations using imported alumina. However, the company now has under construction in Bihar Province an alumina works, which will utilise bauxite deposits located in Bihar, while other bauxite deposits, in Bombay Presidency, have been developed. This alumina works, which will embody the combined war-time experience of the company's Canadian and British associates, will have an initial yearly output of 10,000 tons of alumina, and is designed to be capable of expansion to 40,000 tons per year. It is hoped to begin operation during 1945.

In present circumstances more detailed figures cannot, of course, be given, but it is legitimate to say that since their reduction works came into production the company has been able to take care of India's requirements of aluminium for war purposes. It is possibly needless to add that the whole output of the works is at present being supplied to Government, very largely for R.A.F. and U.S.A.A.F. requirements.

The works were designed and started up with the assistance of Canadian and British technical experts, but the technical and supervisory staff is already predominantly Indian. Arrangements with the Government of India are just being concluded whereby facilities will be given for the despatch of Indian technicians for training in aluminium works abroad. The company feels that with increasing industrialisation and a higher standard of living, a substantial post-war market will exist for aluminium in India, and it is, of course, their intention to expand production and fabrication facilities to keep pace with any future demand.

An American Metallurgical Survey

Some Leading Achievements

A SURVEY of war-time engineering achievements is given in the October issue of *Metals and Alloys*, a U.S. monthly magazine devoted to the metal-working industries. The results of this survey are summarised in the following article.

The magazine asked nearly 150 leading engineers, metallurgists, and production executives the following three questions:

(1) What were in your opinion the leading technical achievements in the development of new materials, in the manufacture and processing of metals and alloys and in their applications during the war?

(2) Which of these developments would you characterise as the most important?

(3) Is this one likely to develop further, and if so, what will be its probable effect on the metal working and metal producing industries in the post-war era?

Light Metals

Great emphasis has been placed by several authorities on the aluminium and magnesium alloys—nearly 25 per cent. of the replies dwelt on these as among the leading developments, and also as likely to develop further.

An authority in the aircraft industry stated that the development of high-strength aluminium alloys was most important as far as the future of aircraft production was concerned. "The possibility of developing this type of alloy to a point where it will effect worth-while savings in weight in airframes is quite possible. The use of a high-strength alloy would mean improvements in machines for metal forming and cutting, particularly the former, since about 80 per cent. of the raw material used in airframe construction is in the form or sheet."

A prominent material engineer considers magnesium technology as the leading technological achievement in the development of new materials and the manufacture and processing of metals and alloys. "Very little magnesium or its alloys was made or fabricated before the war. Now it is a very large industry. Magnesium technology will probably develop further. It will be a competitor to aluminium, steel, and copper-base alloys where weight is a factor."

Two of the war's technical developments reported as having impressed a well-known metallurgist are the recovery of magnesium from sea-water and the process for the continuous pouring of an ingot of aluminium up to any desired size. This latter accomplishment, he believes, makes practicable the continuous rolling of aluminium on a large scale.

"The expansion of the light metal industries, aluminium and magnesium, has been tremendous," in the opinion of a metallurgical engineer. Both these materials have undergone many technological advances in production, alloying and processing, and the extensive use of radiography has aided the production of new high-strength materials with a minimum loss due to melting defects.

National Emergency Steels

On one development in particular there has been unanimity of opinion as to its importance. About 25 per cent. of the answers dwelt on the importance of the development of the National Emergency (NE) steels. "There is no doubt," says a material engineer, "that alloys have been used for many years in excess of requirements and the use of these special steels is going to make us more conscious both of the highest physical properties obtainable and of the application of the proper steel to do the job rather than to supply a steel which is much too good for the application."

In the last five or ten years we have been given methods of measuring quantitatively the effect of various alloys on the properties of steels and irons, is the opinion of a foundry engineer. "We have been shown that in using small amounts of alloys, the effect of one is enhanced by the presence of one or more others. These additions to our fundamental knowledge have led to great changes in our ideas on the best methods of making quality steels and enabled us to make up for shortages of steel-making alloys by the adoption of the NE steels." However, he expresses a doubt whether the latter will continue in use after the war without some changes; yet he does not believe that we shall go back to the former practice of "adding alloys by the bucketful in order to make fool-proof steels." He rather believes that steels will be used with much smaller percentages of alloys, probably each containing several alloys as the NE steels do, and that the best properties in these steels will be secured by proper heat-treatment.

The NE steels with their lean alloy content proved to be as good as their richer brothers in many applications. Their success was due in large measure to better control of fabricating and heat-treatment operations, to new and better heat-treating furnaces, better quenching oils and salt baths. Greater attention was also given to processing, all of which combined to increase our technical and scientific knowledge.

The development, during the war, of high-temperature resisting steels, used in superchargers, gas turbines, jet-propulsion devices, and so on, is another important

sphere. Very little technical detail has been published so far, but knowledge of their existence is general.

It may be expected that gas turbines, when fully developed, will displace both large diesel units and small steam turbines especially in transport equipment. Many types of jet propulsion require metals which retain their strength at high temperatures. The high-temperature resisting metals will enable many types of prime movers to operate more efficiently and at less cost.

Foundry Industry Changes

In this industry, there has been considerable growth of technology, due largely to the opportunity to build complete foundries. Proper planning, due to a proper recognition of the factors involved, produced considerable mechanisation, automatic control, and greater production of higher quality.

A research engineer particularly referred to cast armour plate. One of the leading technical developments has been in the steel casting field, and great improvement has been made in every part of steel foundry practice; the co-operation of steel foundrymen will continue. Heat-treating of steel castings will continue its progress and will be applied to more and more types.

Undoubtedly, one foundry development of great importance and far-reaching consequences is the liquid quenching and tempering of steel castings, recognised as an outstanding war achievement, and the use of water quenching and tempering of cast steels, under adequately controlled conditions, will be greatly extended. Heat-treating equipment in the better foundries will bear only a faint resemblance to that of a decade ago.

Centrifugal Casting

Closely allied to the general foundry industry is the centrifugal casting of metals, either by conventional methods or as precision castings. Such methods have been used much more extensively and, as a result, better physical properties have been obtained, with excellent reproduction and minimum metal losses. Both the ferrous and non-ferrous industries will employ this process more extensively in the post-war period.

The application of the precision casting process, previously used mainly in dental work, has been and is being applied for the precision casting of highly alloyed metals, particularly metals which are not forgeable or machineable. This made possible the production of intricate parts in alloys which previously could not be used, such as superchargers used in aircraft and cylinder barrels. This technique will be considerably developed after the war and will make possible the accomplishment of engineering and processes which have hitherto been impossible owing to the lack of metals of sufficient refractoriness as regards heat, corrosion, and other effects. By this method alloys can apparently be made in non-forgeable, non-machinable grades, which have unique properties, and which can be made in the finished form.

Powder Metallurgy

Powder metallurgy has also been greatly stimulated by the war, so much so that it has expanded into a new and active industry. Selection of proper dies has produced parts with excellent properties and dimensional tolerances which formerly had involved most elaborate machining. Pure powdered metals possess excellent electrical properties which cannot be obtained by conventional casting processes. Porous bearings have been utilised with perfect safety in several instances where conventional bearings will not function.

Progress in the sintered carbide tool industry is by no means being overlooked. The development of sintered carbide tools which, while not new, have extended enormously the machining and forming capacity of the country, has been advanced by the war. Carbide dies facilitate operations, such as drawing steel cartridge cases, which would have been impossible without the new heat and abrasion-resisting material. The improvement made in carbide-tipped tools has in many cases been in the order of 25 to 1 in production capacity. Tungsten carbide, as a cutting tool and a drawing and extrusion die, will enable many metals to be produced in a cheaper form.

Miscellaneous Developments

Among other interesting developments are the plastic bonding of metal to metal, metal to wood and other non-metallic material and plastics with glass fibre fillers. In the field of analytical control, the spectrograph has enabled extremely rapid analyses to be made in hoth tbe ferrous and non-ferrous industries. Production can be greatly accelerated and greater quality is assured. The future use of the spectrograph should not be confined only to the larger industries. As regards strength of materials, a professor distinguished in this field says that the most interesting development during the war period is the study of the property known as technical cohesion strength. This involves a study of the conditions under which normally ductile materials break like brittle materials, even under a few loads.

The chief metallurgist of a large steel company points to the substitution of electrolytic tin plate for the hot-dipped. Eventually a large part of the production of hot-dipped tin plate will be replaced by electrolytic tin plate with a saving in tin in the production of equal or better quality plate at an equal or lesser cost.

Aluminium Alloys

Effects of Minor Elements

"THE Effects of Minor Alloying Elements in Aluminium Casting Alloys" was the title of two lectures which Mr. W. Bonsack, chief metallurgist of The National Smelting Co., Cleveland, delivered before the American Society for Testing Materials; for these lectures, Mr. Bonsack was awarded the Dudley Medal. The author points out that, with the exception of magnesium and iron, which must be carefully controlled, the other alloying elements—there are fourteen common elements in aluminium alloys, which may be desirable alloying elements—are either beneficial or innocuous. Aluminium alloys are sand cast, chill cast, die cast, or worked by forging, rolling or drawing. Two main groups of alloys can be distinguished: the aluminium-copper alloys and their derivatives, and the silicon alloys and their variations. He investigated the influence of the different minor alloying elements both in respect of the physical properties and of the corrosion resistance. The physical properties are relatively easy to analyse, while the corrosion resistance is very hard to prove or to disprove, since no standard tests are available; the few test methods which give information are of value for comparison in theoretical studies of alloys, but they are not a reliable guide for actual service requirements.

Casting and Machining Properties

Furthermore, it is the present practice to use protective coatings, such as anodising or painting, on aluminium castings that are exposed to corrosion. It is, therefore, more important to be well informed regarding the effect of these minor alloying elements on the castability, machinability, tensile strength, heat treatability and stability at elevated, subnormal, and room temperature. In the grouping of properties, castability ranks first, as casting alloys should cast easily in order to be free of defects, such as shrinkage-porosity and cracks, often caused by readily oxidising alloying elements. Machinability comes next in importance. Studies were made with groups of alloys, in which copper was the main alloying element, and it was found that the only element which requires rigid control was magnesium, of which a maximum of 0.10 per cent. can be tolerated without causing loss in ductility. In cases where ductility is of prime importance, limitation of magnesium to 0.05 per cent. is indicated. Iron is the next element which must be watched carefully. Since much of the contamination arises through the foundry process, every precaution should be taken to prevent unnecessary iron pickup. All the other elements such as manganese, titanium, nickel, chromium, and cobalt in one group; and tin, lead, antimony, bismuth, and cadmium in another group, are usually present in amounts small enough not to cause any harm; in fact in many cases their presence is advantageous.

Aluminium-silicon alloys have a lower specific gravity than most other aluminium alloys and their fluidity and mould-filling characteristics are greater than those of most other aluminium alloys. The hardening effect of silicon is lower than that of copper or magnesium. The chemical analysis and physical properties of 33 aluminium-copper and of 17 aluminium-silicon alloys were given by Mr. Bonsack in tables, who dealt also with the effect of the various minor alloying elements.

BRAZILIAN METALS

The Director of Mineral Production of Brazil expresses the belief that, although there will be a reduction in the majority of minerals and metals exportable from Brazil, the problem will be solved by the country's increased industrialisation.

In 1945, when the Volta Redonda Steel Plant is expected to be in operation, an impetus will be given to the establishment of innumerable other special alloy and diverse machinery plants. The aluminium plant in Ouro Preto, Minas Gerais, is to be inaugurated, and the one in Rodovalho, São Paulo, is waiting for the delivery of machinery. Steps are being taken for the establishment of a nickel reduction works in São Jose de Tocantins, Goyaz.

The production of the new cement factories being set up is not expected to be adequate to meet the country's needs. The question of a magnesium industry has been raised, and the production of mineral fertilisers is being studied.

The Director believes that, although the industry may suffer a set-back immediately following the war, it will be more stable when based on the domestic market.

Personal Notes

MR. ADAM TAIT, F.R.I.C., has been elected representative of the Scottish section on the Council of the Institute of Brewing.

DR. F. W. ASTON, F.R.S., is the recipient of the 21st Duddell Medal of the Physical Society, in token of his invention and development of the mass spectrograph.

DR. R. SELIGMAN has been awarded the Platinum Medal of the Institute of Metals in recognition of his outstanding services to the non-ferrous metal industry on both the scientific and the industrial side. The presentation will take place in London on March 14, at the 37th annual meeting of the Institute.

PROFESSOR J. M. MACKINTOSH, M.D., F.R.C.P., D.P.H., Professor of Public Health at the University of London and Dean of the London School of Hygiene and Tropical Medicine, and formerly Chief Medical Officer of the Department of Health for Scotland and Professor of Public Health at the University of Glasgow, has been appointed a member of the Fuel and Power Advisory Council.

MR. H. R. TURNER, a director of Turner & Newall, Ltd., has promised £10,000 to the National Trust towards the fund for the preservation of the Clumber Park estate, Nottinghamshire, provided that the balance of the money (£65,000) is subscribed. Mr. Turner, although he has no family connections with the district, knows its beauties well, and has offered the gift in memory of his mother. His generous action follows an appeal by the Mayor of Buxton in the local Press.

DR. HENRY DE LASZLO, managing director of L. Light & Co., Ltd., fine chemical manufacturers, Old Bowry Laboratories, Wraysbury, is leaving this week on a business trip to the U.S.A., Mexico, Portugal, and Spain. His object is to make a survey of organic intermediate chemicals manufactured in the U.S.A., as well as to ascertain their prices and arrange for contracts for future delivery, with a view to working them up into high-value dyestuffs, perfumes and pharmaceutical products. If any manufacturer has any specific inquiry he should communicate direct with L. Light & Co., Ltd., giving some indication of his annual requirements. While in the States, Dr. de Laszlo proposes purchasing out-of-the-way organic research chemicals which are not manufactured in Great Britain. Any research worker who cannot obtain any particular substance over here may wish to make use of this opportunity.

Moulding Clay

Application in Industrial Problems

MOULDING clay in the hands of the designer has always been a useful asset, and no doubt when the full story can be told of the many uses to which it has been put to in the planning of the progress of the war, it will be realised that this material has played a part equal in importance to many better known materials.

The C.E. Moulding Clay, made by the Kent Chemical Co., Ltd., 27 Elmwood Drive, Bexley, Kent, is a permanently plastic clay that lends itself readily to moulding by hand. It is waterproof and clean, and does not stain the hands or clothing. This clay is made in four colours, green, yellow, blue, and red; it is a useful medium as a mould for the accurate reproduction of awkwardly situated or unusual shapes, such as vee-grooves, gear-teeth, and fillets, and as a means of determining the internal profiles of objects difficult to measure.

It may be employed, for instance, when it is desired to ascertain the actual thickness of foundry crucibles after a certain number of melts have been effected, in order to ensure that the crucible is safe enough for further use. It can also be used, by sandwiching the various colours of clay together, to demonstrate the grain flow of metals when they are under the influence of compression or rolling action, or it may serve as an aid in the teaching of machine drawing where difficulty might be experienced by the student in understanding the correct method of indicating a complicated section. It has obvious applications in the modelling of building schemes or extensions; and there are immense possibilities for its employment in laboratories, research and experimental departments, drawing offices and studios, and in every other field where progress can be improved by the creation of a "mock-up" or replica.

COLLOID EQUIPMENT CO., INC., 50 Church Street, New York, announce the development of a new Delmhorst Moisture Detector for timber and wood products and various construction materials resulting from many years of intensive development work by W. J. Delmhorst in the field of equipment for quick moisture determinations. It takes advantage of the latest ideas in electrical circuits and electronic principles, which have been combined in a meter covering the range of 7 to 25 per cent. moisture, with an accuracy of ± 1 per cent. The electrode needles are driven into the material to be tested and the reading is then taken by turning the dial knob until a small light flashes above the dial.

General News

From Week to Week

Equipment for Britain's largest penicillin plant is being constructed by an engineering firm in the Tees-side area, where a development board, linking up with the North-East Development Association, has been set up.

The name of the Bureau of Chemical and Physiological Abstracts has, as from January 1, been changed to the Bureau of Abstracts, and its publication will be entitled *British Abstracts*; they will be issued in the same seven sections as hitherto.

"The Story of DDT and its rôle in Anti-pest Measures," was the title of a paper read by Messrs. T. F. West and G. A. Campbell at a meeting of the Microbiological Panel of the Food Group of the Society of Chemical Industry held on January 31.

The Minister of Supply has made the Control of Lac (No. 3) (Revocation) Order, 1945, which revokes the Control of Lac (No. 2) Order, 1943. Licences are no longer necessary for the disposal, acquisition and use of lac.

The Control of Paper (No. 67) Order, 1945 (S. R. & O. 1945, No. 31), which came into force on January 22, increases the maximum prices for electrical insulating board, press-pahn boards and glazed ammunition boards, and textile press papers.

The Scottish Seaweed Research Association has decided to go ahead with two years' research in West Scotland. On the advice of Mr. B. G. McLellan, F.R.I.C., M.I.Chem.E., director of the Association, the first work will be to investigate the volume of seaweed available, the period of growth, and the best and most economic methods of collection and delivery.

A revised edition of the British Standard colour card B.S. 381C has just been issued, price 1s. In this revision the range of paints recommended for general purposes has been increased; there are now 27 colours, together with black and white. Two separate groups deal with special colours for identification purposes and for the painting of vehicles. Information on the reflection factors of the colours is also given.

Concern is expressed by the Metropolitan Water Board regarding the effluents likely to arise from the manufacture of penicillin, both from the standpoint of their discharge into the rivers and their disposal on gathering grounds of wells. It urges the Ministry of Health to take appropriate action in preventing the discharge of such effluents in localities where they may gain access to the chalk from which the Board derives its underground water supply.

Any worker in the Nuffield Organisation who holds local public office, or may seek and be elected to such a position, will be granted leave of absence with pay to fulfil his duties, according to an announcement by the vice-chairman, Sir Miles Thomas. In an interview, Sir Miles declared: "It is only right that every employee should have an opportunity of representing his fellow townspeople in matters of local government. Representations have been made to me that a few would seriously consider entering the field of local politics if they could be sure that by so doing no financial hazard were involved. An assured income for our public-spirited employees should do much to encourage a livelier and more active interest in municipal matters."

Foreign News

The Aluminum Company of America is to shut down its Defense Plant Corporation Plancor Unit; however, this $20,060,000 unit will be maintained in a stand-by condition so that operations may be resumed if conditions warrant. Its construction was started in October 1941; production of aluminium was begun about six months after ground was broken.

A site for the new steel plant, estimated to cost 1500 million pesos, has been selected at Hualpencillo, in the Concepción zone of Chile. Production estimated at 150,000 tons of steel yearly will be sufficient to supply Chile's needs. Subsidiary industries are to be fostered in the zone, and gas, resulting as a by-product, will be supplied to towns situated between Concepción and Santiago.

In an address on "Metal and Mineral Problems in War and Reconversion," Mr. P. D. Wilson, vice-chairman for metals and minerals, U.S. War Production Board, stated that W. P. B. contemplates no change in procedure of administering the premium price plan after the war; the Government will continue to pay for copper 13 cents per lb., for lead 8 cents, and for zinc 11 cents; it will also continue the supervision of metal reserves.

Argentine manufacturers of insecticides and fungicides have faced a difficult situation because of the shortage of copper sulphate. Sufficient white arsenic has been available from Mexico to permit the industry to meet all requirements for calcium arsenate and Paris green, but fruit growers are handicapped by serious shortages. Pyrethrum plantations established in the San Juan area so far have not yielded the quantities estimated.

Sweden's four leading chlorine producers have decided to form a joint company with its seat in Stockholm.

A new bacterial fertiliser—"Azotogen"—has been developed at the U.S.S.R. Institute of Agricultural Microbiology. One pound of the material is sufficient for 10 acres of land planted to grain or 3 acres in vegetables, and the yield is said to be increased from 20 to 30 per cent. This product replaces mineral fertilisers which are in short supply in Russia.

"China To-day," is the title of a booklet published by the Central Union of Chinese Students, c/o Chinese Institute, 64 George Street, Manchester, 1, price 1s. 2d. (post free). Those interested in the progress of chemistry in China—on which attention was focussed in a recent issue of THE CHEMICAL AGE—will be interested to read an article on this subject by Professor Tseng Chou-lun, as well as a reprint of an article written for *Nature*, by Dr. J. Needham, on "Science in Chungking."

Forthcoming Events

February 3. British Association of Chemists (St. Helens Section). Radiant House, St. Helens, 7.30 p.m. Dr. G. H. Whiting: "The Pottery Industry."

February 5. Leeds University, Public Lecture. General Lecture Theatre, 5.15 p.m. Sir Alexander Fleming: "Penicillin."

February 5. Society of Chemical Industry. Chemical Society's Rooms, Burlington House, London, W.1, 2.30 p.m. Dr. F. Bergel: "The Use of Amino Acids and Sugars for the Synthesis of Foods of Nutritional Importance."

February 6. Plastics Group (S.C.I.) and **Oil and Colour Chemists' Association.** Manson House, 26 Portland Place, W.1, 6 p.m. Mr. J. D. Morgan: "The Use of Cashew Nut Shell Liquid in Resins."

February 6. Electrodepositors' Technical Society (Birmingham Section). James Watt Memorial Institute, Great Charles Street, Birmingham, 6 p.m. Messrs. S. R. Goodwin and H. A. Bechtold: "Influence of Anodes on Plating Processes."

February 7. The Institute of Fuel (Yorkshire Section). Royal Victoria Station Hotel, Sheffield, 3 p.m. Dr. R. J. Sarjant: "The Insulation of Furnaces."

February 7. Society of Public Analysts. Chemical Society's Rooms, Burlington House, London, W.1. 3 p.m. Physical Methods Group, inaugural meeting. Mr. R. C. Chirnside, "Physics and the Analyst"; and (4.30 p.m.) Mr. H. P. Rooksby, "Some Examples of the Use of the X-ray Powder Diffraction Method in Quantitative Analysis."

February 8. The Pharmaceutical Society of Great Britain, Society's House, 17 Bloomsbury Square, London, W.C.1, 7 p.m. Dr. S. A. Sarkisov: "The Health Services of the Soviet Union."

February 8. Chemical Society and **University College of North Wales Chemical Society.** University College, Bangor, 5.30 p.m. Professor M. Polanyi, F.R.S.: "The Strength of Carbon Bonds."

February 9. Royal Institute of Chemistry (Cardiff and District and South Wales Sections). Mining and Technical Institute, Bridgend, 6 p.m. Professor W. H. Linnell: "Chemotherapy."

February 12. The Institute of Fuel (North-Eastern Section). Central Station Hotel, Newcastle-upon-Tyne, 5.15 p.m. Mr. J. S. F. Gard: "The Insulation of Pottery Furnaces, Kilns and Carbonising Plant."

February 12. Royal Institute of Chemistry (Leeds Area Section). Chemistry Lecture Theatre, Leeds University, 6.30 p.m. Dr. H. Phillips: "Wool—Some Recent Investigations of the Chemical and Physical Properties of a Natural High Polymer."

February 13. The Chemical Engineering Group (S.C.I.) and the **Institution of Chemical Engineers.** Rooms of the Geological Society, Burlington House, Piccadilly, W.1, 2 p.m. Mr. J. Watson Napier: "Ammonia Synthesis from Coke Oven Gas."

February 14. British Association of Chemists. Caxton Hall, Westminster, 6.30 p.m. Professor Harold Laski: "The Place of the Scientist in Post-War Administration."

February 14. The Institute of Fuel. Grosvenor Museum, Chester, 2.30 p.m. Mr. A. L. Longworth: "Thermostatic Control as an Aid to Efficiency in Fuel Utilisation."

February 15. Chemical Society. Society's Rooms, Burlington House, Piccadilly, W.1, 2.30 p.m. Messrs. L. Bateman, E. Hughes and C. Ingold: "Molecular Compounds between Amines and Sulphondioxides. A Comment on Jander's Theory of Ionic Reactions in Sulphondioxides"; Mr. S. H. Harper: "Experiments in the Synthesis of the Pyrethrins." Part I: "Synthesis of Chrysanthemum Monocarboxylic Acid"; and Messrs. N. Barton, G. Duncannon, J. Cook, W. Graham and J. Loudon: "Studies on the Chemical Constitution of Colchicine."

February 16. Leeds University, Public Lecture. Chemistry Department, 1.20 p.m. Professor G. M. Evans: "Plastics—From Molecules to New Materials."

February 16. Society of Chemical Industry (South Wales Section). Royal Institution of South Wales, Swansea, 6.30 p.m. Mr. N. Swindin: "The Treatment of Spent Pickle."

February 16. Society of Chemical Industry (Birmingham Section). Birmingham Chamber of Commerce, 6.30 p.m. Dr. G. A. Gilbert: "Some Physico-Chemical Aspects of the Process of Dyeing."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Company Winding-up Voluntarily

THE EASTERN CHEMICAL CO., LTD. (C.W.U.V., 3/2/45.) January 11. Stuart R. Cooper, 14 George Street, Mansion House, London, E.C.4, appointed liquidator.

Company News

Genatosan Co., Ltd., is again paying an interim dividend of 10 per cent.

The Steel Corporation of Bengal announces an interim dividend of 3¾ per cent. (same) for the year to December 31, 1944.

Milton Antiseptic Co., Ltd., is paying a final ordinary, for the year to September 30, of 10 per cent., making 15 per cent. (12½ per cent.)

Baldwin Chemical Industries, Ltd., have increased their nominal capital of £1000 by the addition of £19,000, divided into 19,000 £1 shares, of which 10,000 shall, if and when issued, be 7½ per cent. cumulative preference.

Cleveland Petroleum Company, Ltd., announces a net profit for the year to October 31, of £41,651 (£43,458). A dividend of 10 per cent. (same), on the ordinary and a dividend of 13½ per cent. (same) on the deferred, were declared.

The full report of the **Electrolytic Zinc Company of Australasia** states that 2686 ordinary £1 shares in I.C.I. (Australia and New Zealand) were acquired by way of capitalised dividend, and, since June 30, 29,998 shares of a further issue have been taken up, making the total holding 56,402 shares. Through Shale Oil Investigations, Ltd., in which an additional 7000 £1 shares were taken up, the company has continued in the search for oil in New Zealand.

New Companies Registered

Graham Stanley, Ltd. (392,639).—Private company. Capital £500 in £1 shares. Manufacturers of and dealers in chemicals, fine chemicals and chemical products, etc. Subscribers: Joy Bates, W. J. Bates. Registered office: 1 Laurence Pountney Hill, E.C.4.

Delanium, Ltd. (392,637).—Private company. Capital, £50,000 in 25,000 "A" and 25,000 "B" shares of £1 each. To undertake and promote research into the production for coal, oil and other materials of value in commerce and industry, to operate gas, coke-making and other plant; chemical manufacturers, engineers, metallurgists, coal and coke merchants, tar oil and bitumen refiners and distillers, dye and plastic manufacturers, clayworkers, etc. Directors are: B. C. Westall, director of Thos. De La Rue & Co., Ltd.; C. G. R. Ashton, director of De La Rue Plastics, Ltd.; H. P. Bridge, director of De La Rue Plastics, Ltd.; E. L. Hann, director of Powell Duffryn Associated Collieries, Ltd.; J. G. Bennett, director of C. D. Patents, Ltd.; H. V. Vale, director of Cory Bros. & Co., Ltd. The three first-named represent the "A" and the three last-named the "B" shareholders. Registered office: Imperial House, 82-86 Regent Street, W.1.

Chemical and Allied Stocks and Shares

FOLLOWING their recent reaction, industrial shares developed a better tendency, the lower prices attracting a little buying, and in many cases earlier declines were partly regained. Stock markets generally have been firm, with British Funds well maintained, and home rails tending to improve pending the dividend announcements of the main line companies. The better trend in industrials was due in part to the decision to form two companies, whose object will be to assist the post-war financing of industry. With the war still tending to centre attention on the difficulties and problems of the switch-over to peace-time working, there has again not been a great deal of buying of industrial shares; but on the other hand, selling was on a very moderate scale.

Imperial Chemical at 38s. 10½d. were little changed on balance, with B. Laporte well maintained at 86s. 3d., and Greeff-Chemicals 5s. ordinary at 8s. 9d. held most of their recent rise. Borax Consolidated at 37s. remained relatively steady on expectations that the forthcoming results are likely to show maintenance of the dividend at 7½ per cent., while British Aluminium at 45s. 9d. kept up well. De La Rue were firm at 195s., and Powell Duffryn higher at 23s. 10½d. on plastics developments. British Industrial Plastics 2s. shares were 6s. 3d., and Erinoid 5s. ordinary 12s. In other directions, Lever & Unilever moved higher at 47s. 3d., with Lever N.V. 45s. 9d. United Molasses 6s. 8d. units have been active at the higher level of 38s. 3d., and Distillers units rallied to 109s. 3d. British Plaster Board were 38s. 9d., and Turner & Newall rallied to 86s. Amalgamated Metal were 17s. 9d., Barry & Staines 51s., British Match 41s. 3d., and J. Brockhouse firmed up to 79s., with Dunlop Rubber higher at 47s. 3d.

Richard Thomas at 13s., and Baldwins at 6s. 10½d. were better on the latest Welsh tinplate developments. Iron and steels generally became firmer, with United Steels

25s. 9d., Stewarts & Lloyds 57s. 6d., and Staveley 52s. 9d. Dorman Long 27s. 9d., Guest Keen 38s., and Consett Iron 6s. 8d. units were 8s. 4½d. Babcock & Wilcox strengthened to 53s. 6d., while International Combustion moved up to £7½, the latter on the higher distribution.

Textiles showed a revival of interest. Bleachers rallying to 14s. 6d., Calico Printers to 19s., while Bradford Dyers at 27s. responded to market talk of the possibility of a moderately higher dividend. Courtaulds at 55s. 3d. lost an earlier small rally, the disposition being to await the dividend announcement due before the end of February; general expectations are that the dividend is again likely to be kept at 7½ per cent., and main market attention may attach to the chairman's references to the position and outlook of the rayon industry. British Celanese rallied to 31s. 9d., with the second preference receiving more attention around 31s. 7½d. on yield considerations.

Boots Drug strengthened to 54s. 6d. Timothy Whites were 41s., and Sangers 30s. 3d. British Drug Houses were 31s., Burt Boulton 24s. 6d., Cellon 5s. shares 23s. 6d., Monsanto Chemicals 5½ per cent. preference 23s., and W. J. Bush ordinary remained firmly held and quoted at 70s. Fisons were 51s. 3d., with British Glues & Chemicals 4s. ordinary higher at 9s. 3d. General Refractories kept steady at 17s. 1½d., with Imperial Smelting 13s. 3d., Metal Box 90s. 7½d., and Murex 101s. 3d. Wall Paper Manufacturers deferred remained at 42s., but among paint shares, Pinchin Johnson 10s. ordinary became firmer at 39s. Oil shares were slightly easier with Anglo-Iranian 109s. 4½d., Shell 83s. 9d., and Trinidad Leaseholds 96s. 10½d. Ultramar Oil moved up sharply to 81s. 9d. on the latest developments.

British Chemical Prices

Market Reports

REPORTS from most sections of the London general chemicals market indicate active trading conditions and there is a fair amount of fresh inquiry in a wide range of products. Actual fresh business is not extensive due chiefly to the supply position, but deliveries against existing contracts are going forward satisfactorily. Values throughout the market are on a strong basis. Among the soda compounds, solid caustic soda is being taken up against contracts fairly steadily and a good demand is reported for caustic liquor. There has been no change in the position of industrial refined nitrate of soda, which continued in steady request. Yellow prussiate of soda continues in short supply, and Glauber salt and salt cake are in brisk demand. The potash chemicals generally are exhibiting a strong undertone, although no actual changes are recorded. Makers of permanganate of potash are meeting with a persistent demand and supplies are being steadily absorbed. Yellow prussiate of potash is available in limited quantities, while acid phosphate of potash is a firm market. In the coal-tar products section an active inquiry is reported for the benzols and toluols. Contracts in cresylic and carbolic acids are being steadily drawn against, and the pyridines are in good request.

MANCHESTER.—Heavy chemicals for the textile and allied trades in Lancashire and the West Riding are being called for in relatively good quantities on the Manchester chemical market, while other leading industrial outlets are meeting their requirements as a rule at around their recent levels. Caustic soda and other alkalis are experiencing a steady demand, while the general run of potash compounds are being absorbed to the full extent of the quantities that are making their appearance. Carbonate of ammonia and other ammonia salts are meeting with a fair inquiry, while most of the acids are in good request. Values are strong in pretty well all sections of the market. Among the tar products, crude tar, creosote oil, and toluol and benzol are all active, while a fair trade is passing in the naphthas and cresylic acids.

GLASGOW.—In the Scottish heavy chemical trade, business during the past week has been rather quiet in the home trade. Prompt deliveries by road and rail transport have been rather difficult for some time. Prices remain very firm, while export inquiries are still limited.

Price Changes

Owing to a printer's error, the prices of barium carbonate and barium chloride were confused in our last week's issue (p. 109). They should read as follows.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. Packing included.

Barium Chloride.—98/100%, prime white crystals, £17 10s. to £19 10s. per ton, bag packing, ex works.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

Telegrams: ALLANGAS FLEET LONDON — Telephone: CENTRAL 3212 (10 lines)
GLASGOW: 116 Hope Street (Central 3970) — BIRMINGHAM: Daimler House, Paradise Street (Midland 0784-5)

THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LII
No. 1336.

February 3, 1945

Annual Subscription 21s.
Overseas 26s.

The Industrial Reversion

IT is already clear that the reversion from war to peace production will bring with it serious problems. These problems will vary in different industries and their difficulty will depend upon how far war-time production has been different from normal peace production. The chemical industry may find that its problems are more simple than those of many others. Many chemical works have not appreciably changed their products; a plant built for sulphuric acid production, for example, cannot be made to produce other substances. Those that have changed their manufactures have done so by putting in new plant which can be used for other purposes if the war-time product is no longer required in times of peace. Probably most war-time chemical products, except some explosives, are needed at any time — though possibly in lesser quantities.

The change-over will concern the order book rather than the methods of manufacture. Before peace production can get into swing, orders must be forthcoming. It is not to be expected that there will be any lack of orders for a time, but some of those orders should be placed before hostilities cease, so that the gap may be as short as possible and a temporary period of unemployment avoided. Some firms are believed to have their order books already well filled with contracts that will only come into effect when the Government permits the change over. The engineering industry, on the other hand, will experience many difficulties. The intensive production of guns, aeroplanes, bombs, shells, jeeps, and other engines of war will cease, and works organised for war production will have to be reorganised and probably re-equipped for the arts of peace.

The re-equipment of industry will be one of the major problems that practically every firm will be obliged to undertake. Some equipment is worn out, some is out of date, some older plant will need to be scrapped and replaced. The decision when to do this may not rest wholly with industry. On every side industries are announcing their plans for post-war plant and capital equipment reconstruction. One industry after another is calling for new plant to the tune of hundreds of millions of pounds' worth. The engineering industries of the world cannot possibly cope with the flood of orders that will be thrust upon them by these demands.

On Other Pages

Moreover, it would be foolish in the extreme to allow a period of frantic reconstruction to be crowded into three or four years, and to be followed by a long period of trade depression. During the last war, for example, the coke-oven industry of this country was largely rebuilt, with the result that, from 1920 to 1932, scarcely a plant was ordered. This time, the modernisation of the coke ovens and of the iron and steel works was largely completed before the outbreak of war; the war will end with these plants sadly in need of repairs and maintenance and perhaps even of complete renewal. On all sides there will be a clamant demand for new equipment. Some regulation is clearly necessary, and it would seem that each industry might be called upon to do its own regulation. The Government might allocate steel and other materials by industries and leave a system of priorities to be worked out by each Trade Association concerned.

Meanwhile, the Board of Trade is completing its plans and is setting up a regional organisation which is "to supervise the change-over to peace-time production and bring about what redistribution of industry is now, or may be in the future, within its control." Twelve regional controllers have been appointed in this country, and one in Northern Ireland. This regional organisation is to be on a permanent footing, and it does not seem likely that the bureaucrats will lightly relinquish the control they have so rigorously exercised in the years that are past. Not easily did Sinbad release the grip of the Old Man of the Sea. The President of the Board of Trade has recently outlined his plans for this new organisation. Its first function is innocuous and even useful. The regional offices will maintain a survey of industrial conditions, they will report current facts and they will be centres of local information to the Board of Trade and to industrialists. In addition to this they will have four main functions. The first is the reconversion of industry to peace production. It is expected that the problems of engineering will occupy most of the energies of the regional offices under this head. No doubt there will be problems to be solved that will require the assistance of the Government, and provided that assistance is given in the right spirit much good may result. It is necessary that the special difficulties of industry should be appreciated and should be treated sympathetically.

The second function will be the derequisitioning of factory and storage space and the allocation of surplus Government factories to industry. This is, of course, a Government problem, and must be handled by the Government. It is understood that the Government do not propose to sell factories outright, but to lease them to selected firms. There are about 1000 of these factories to be leased to private enterprise, and in selecting the lessees, the Board of Trade proposes to take into account its own views on industrial location. Moreover, in settling the order of release of factories taken over for war work or storage, there is to be control over the development of production in conjunction with the control of materials and labour. Just how long this sort of control is to be maintained we should like to know. The Board of Trade seems to desire that it shall be permanent. This is borne out by the last two functions of the regional controllers. These are (1) the distribution of industry, with special regard to the new development areas, and (2) the deconcentration of civilian industry and the release of materials and labour.

Mr. Dalton has stated that the duties of these regional controllers will be to maintain a continuous survey of the industrial prospects of their regions so that future industrial changes shall not take the Government by surprise. The war situation makes it necessary that controls should be maintained for the present. The Government can help industry by giving assistance where it is needed, but leaving private enterprise alone to get on with the job where assistance is not required. Grandmotherly "control" is the last thing we want. The nation is frankly suspicious of apparent attempts by Government departments to perpetuate war-time controls. The expressed intentions of the new organisation could be helpful, and on the contrary they could lead to the perpetuation of undesirable control. The nation and industry will watch developments critically.

NOTES AND COMMENTS

Silesia

AMONG the changes that are being wrought in front of our eyes on the map of Europe, the entry of the victorious Red Army into the Silesian industrial region is of the utmost importance. To the average person in this country, Silesia, tucked away in a forgotten corner of that troublesome borderland between Central and Eastern Europe, has meant very little. The industrial areas in Western Europe have always commanded greater attention, and it is not generally realised that the first coal mine on the Continent was sunk in Upper Silesia in the middle of the 18th century, that the first steam engine for pumping water was installed in a mine there, and that there coke was first used in blast furnaces for the production of iron. It was owing to the more rapid development of Western Europe in the wake of the British Industrial Revolution that the Ruhr, advantageously situated from the point of view of markets and transport, gained supremacy. Up to 1914, Silesia, situated at the junction of three Empires, had an unequal development. The Dombrova coal basin with Katowice as centre was of little interest to the Russia of the Tsars. The part belonging to the old Reich was known for its zinc and lead output, while the Austrian part, the Olsa region, with Moravská Ostrava, Teschen and Karwin, with its extensive deposits of high-grade coal, became the chief industrial area of the Dual Monarchy.

Germany's Eastern Arsenal

WHEN the Allied bomber offensive got into its stride in 1941, the Nazis began to look to Silesia, which had been developed further in the inter-war years, as an alternative to the Western industrial regions. "Greater Upper Silesia," extending over 8000 square miles, with a population of about 4½ million, was formed with the idea of promoting a vigorous exploitation of the area, which also served as a reception area for engineering concerns evacuated from the West. Details about recent developments are scarce; coal output, amounting to 65 million tons a year before the war, probably reached the 100-million mark in 1944. Indeed, Europe's largest reserves of coal are in these parts. A powerful oil-from-coal industry was built up, with an output of at least a million tons of finished products per annum. Many hydrogenation units are understood to be situated underground, literally in the coal pits. Closely connected with this industry is, of course, a coal-based chemical industry. In addition, large supplies of limestone made possible the production of 20 per cent. of Germany's total cement output. Heavy chemicals, including fertilisers, were also produced. In 1938, Silesia accounted for 10 per cent. of the world's zinc output, concentrated near Beuthen, and it is assumed that 10-15 per cent. of the Reich's requirements of steel and other metallic minerals were lately supplied by this area. If we add to this impressive record the fact that Silesia was self-sufficient in food, we become aware of the terrific effect its loss must have on Germany's war potential, as well as of its importance in the future industrialisation of Europe.

The Future of Research

A TRIBUTE to British scientists was paid by Mr. Attlee, who was the chief guest at a luncheon of the Parliamentary and Scientific Committee at the Savoy Hotel, London, on Thursday last week. The British scientist, he said, had added to his reputation as an abstract scientist by proving that he was second to none in the application of science to the practical problems of war. After the war, he believed, the Government and the scientist would play their parts, but industry as a whole must become more "research-minded." Large businesses must welcome co-operation; small businesses must group themselves together. It was, moreover, not sufficient to ask for money to be spent on research by the Government. The prime essential was the provision of first-class scientists, both in the research departments of the Government and in the key positions in industry itself. Sir Ernest Simon, chairman of Manchester University,

asked for better facilities at the universities, notably in laboratory equipment. It was essential, he said, that increased finances should be available in order to plan ahead effectively. He made the point also that whereas, between the wars, firms in new industries had developed scientific research with great success, most of the older industries and those operating in small units had made little or no progress. This, we consider, is a rather sweeping statement, but it undoubtedly contains a grain of truth. To counteract it, however, there has been a great development in research among most of the older industries since the war started, and we see no reason why this admirable impulse should not continue to be felt after the war. With the Government adopting a favourable attitude to those willing to expend their energies in research, as Mr. Attlee's words seem to indicate, we do not feel we are too optimistic when we suggest that there is the possibility of a reasonably rosy future for industrial research in Britain. The men are there, at any rate; the stress of war has proved their worth. Industry can surely not be so shortsighted as not to employ their skill.

Industrial Health

THE creation of a comprehensive industrial health service as an essential part of the National Health Service is being strongly urged by a special committee on social and preventive medicine formed by the Royal College of Physicians. Increase in industrial efficiency must remain an idle dream if the workers cannot attain a high standard of health. Bold planning without regard to traditional arrangements, and the extension and strengthening of legislation covering industrial undertakings of all sizes are advocated. The anomaly whereby the factory inspectorate is under the control of the Home Office should speedily give way to a unified and universal system. It is a true but distressing fact that the medical service in industry is at present confined to rather less than one-fourth of the workers in this country. Units with fewer than 250 workers, employing, in 1939, over 50 per cent. of the total workers, are deprived of such a service.

Finding the Right Job

ON the psychological side of industrial health, we are even worse off. According to Sir Edward Mellanby, secretary of the Medical Research Council, there seems to be a good deal of inertia and even antagonism in this country, when the psychologist is trying to fit people into the right jobs. He made a most significant declaration on this subject at a private conference on health research in industry, which was held last September, the proceedings of which have just been made public. At this conference he insisted on the stupidity of considering that most people are mentally and physically capable of doing any kind of job. To continue on those lines, he says, means condemning many men and women to destitution, just because they are unfit for *some particular* job. As a result, enactments would have to be framed to cater for the lowest common denominator of human capacity, at the expense of industrial efficiency. And, that, as Sir Edward justly claims, we cannot afford. The use of new methods, including intelligence and occupational tests, is required to fit people into right jobs from the beginning, thus avoiding "blind alleys." We gladly support these proposals, for we believe that the holding of conferences and the printing of reports—however good they may be—are not sufficient, but that adequate publicity, through all the media available, is needed in order to "create demand," instead of perpetuating inertia.

A good market for paraffin wax exists in the State of S. Paulo, Brazil, and, in view of needs of war-born industries, the demand is expected to increase. Average annual consumption of paraffin wax in the State approaches 550 metric tons, of which about 25 per cent. goes to match manufacturers and 20 per cent. to manufacturers of waterproofed textile products. The candle-making industry is now using stearin as a substitute in most cases. Manufacturers of floor wax have also found domestic ingredients to replace paraffin; the most usual of these is carnauba.

Progress in Drugs, Fine Chemicals and Biological Products in 1944—III

by G. COLMAN GREEN, B.Sc., F.R.I.C., A.M.I.Chem.E.

(*Continued from* THE CHEMICAL AGE, *January* 27, 1945, *p.* 102)

INCREASING attention is being directed to bacteriological applications of synthetic detergents and wetting agents. Chemicals of this class fall into one of two groups according as they are effective through a cation or an anion. The basic feature is their ability to orientate at the interface, and this surface activity confers upon them their first property as wetting agents, enabling them to assist in the physical removal of micro-organisms from the surface which they contaminate. A second property conferred upon them by their surface activity is the ability to damage the membrane at the protoplasmic surface of the micro-organism, thus interfering with the control of selective diffusion into and out of the cell, which leads ultimately to death.

Turkey red or sulphonated castor oil was the first substance to compete with soap as the universal wetting agent at the turn of the century. Following Reychler's work in 1916 the sulphonic acids of the fatty acids were developed, and later the sulphated fatty alcohols and the corresponding esters and amides. The detergent action of ordinary soaps is due to the structure of the anions. This is also the case with sodium cetyl and sodium lauryl sulphates, these anionic detergents being bactericidally effective mainly against gram-negative organisms. During 1944 there have been made available in this country higher secondary alkyl sulphates derived from "cracked" petroleum crudes fractions containing long-chain olefines. The mixture is fractionated and a cut is taken corresponding with a carbon content of C_{10} to C_{18} per molecule. This cut is sulphated, neutralised, and purified.

Cationic Detergents

The cationic detergents (in which the long-chain hydrophobic group is situated in the cation) are generally more effective germicidically, being active against both gram-positive and gram-negative organisms. The individuals of this group chiefly in use are quaternary ammonium halides, the simplest being cetyltrimethyl ammonium bromide (CTAB) which is available under brand names. Domagk, whose name is closely associated with sulphonamide chemotherapy, introduced a variant in alkylbenzyldimethyl ammonium chloride in 1935 —R. $C_6H_5.CH_2.(CH_3)_2$ NCl—in which R is a mixture of radicals derived from coconut oil (Zephirol or Zephiran). This latter class of substance has been made available under brand names also, and it and its variants have been reported upon favourably as skin and wound disinfectants. They may be prepared by reacting the higher alkyl-substituted dimethylamines with α-halogen-substituted benzyl compounds (*this Journal*, 1944, *51*, 399).

$$R.N(CH_3)_2 + R'CH_2Cl \rightarrow \left[R' \overset{CH_3}{\underset{CH_3}{\overset{|}{\overset{+}{N}}}}-CH_2.R \right].\overline{Cl}$$

Williams *et al.* (*Lancet*, 1944, 6303) have continued their investigations of CTAB as a wound cleanser, and report favourably on its routine use for this purpose.

It has been stated that the most potent compound discovered in one comprehensive investigation in this class of compound is *p* - **di** - *i s o* butylphenoxyethoxyethylbenzyldimethyl ammonium chloride.

p-di-*iso*butyl.$C_6H_4O.CH_2.CH_2O.CH_2CH_2.$

$$\left[\overset{CH_3}{\underset{CH_3}{\overset{|}{\overset{+}{N}}}}-CH_2C_6H_5 \right].\overline{Cl}.$$

This substance, under the brand name "Hyamine 1622," has been almost entirely absorbed by the U.S. Navy as a disinfectant and germicide.

Another introduction in this group is "Phemeride" or *p-tert*-octylphenyldiethoxybenzyldimethyl ammonium chloride which, it is reported, is bactericidal to *Staphylococcus aureus* in broth in 10 min. at a dilution of 1 : 20,000. It is readily soluble in both water and alcohol, and its bactericidal range is within a dilution which does not inhibit leucocytes. Iland (*Lancet*, 1944) points out that Schulman has shown that surface-tension-lowering substances penetrate and disperse lipoprotein monolayers, a function which can be related with their lytic activity towards red blood corpuscles, unicellular animals, and bacteria. As expected, on this basis, "Phemeride" is not only bactericidal but is hæmolytic at higher concentrations, a dilution of 1 : 1000 causing lysis in one hour.

The use of these synthetic detergents as wetting agents in the textile and laundering industries was established before Domagk recognised their disinfectant properties. An interesting application in this use has been described by Courtney Harwood and other members of the staff of the British Launderers' Research Association (*Lancet*, 1944). It is of great importance

that dust should be kept at a minimum to prevent cross-infection in hospitals. Dust arising from bedclothes contributes greatly to cross-infection and evidence in favour of reducing this to a minimum by oiling both floor and bedclothes has been rapidly accumulating since 1940. The authors have developed a precise technique in which technical white oil was absorbed by the textile to which application was desired to any required degree. Wool was treated with an emulsion stabilised with "Fixanol C" (cetyl pyridinium bromide), a cation active emulsifier, while cotton goods, after treatment with this emulsion, were further treated with a negatively charged emulsion using "Teepol." An important feature rendering the process economical was that, under the conditions specified, the oil was completely absorbed from the emulsion and there was consequently no loss.

Wright *et al.* have demonstrated that, in a particular test, bedclothes were a reservoir of a streptococcus causing cross-infection in a measles ward. Oiling the bedclothes by the technique referred to reduced the streptococcus count at the time of bed-making from 100-150 per 50 cu. ft. of air to nil, while cross-infection by the epidemic strain was reduced from 73.3 per cent. in the control ward to 18.6 per cent. in the "oiled" ward.

The Effect of Soaps on Phenols

Trim and Alexander (*Nature*, 1944) have explored the effects of soaps and synthetic detergents on the biological activity of phenols. They correlated the anthelmintic action of hexyl resorcinol in the presence of sodium cholate, sodium oleate, and CTAB with the interfacial tensions of these substances measured against an inert mineral oil. They found that the maximum rate of penetration of a given concentration of hexyl resorcinol into the test *Acaris* corresponded with a minimum interfacial tension. Beyond this maximum value micellar aggregation set in and the phenol, being present in fixed amount, distributed itself between the micelles and any other interface present. Increasing the concentration of the surface-active agent merely increased the number of micelles until ultimately, in effect, all the phenol was held by the micelles. At this point the difference between the interfacial tensions of the test solution and the soap solution was negligible and, at this point also, the biological activity of the solution of hexyl resorcinol, plus soap solution, as measured by penetration into *Acaris*, was negligible. The authors observe that this picture of competition between biological interface and micellar interface should be generally valid, not only for all types of phenol, but also for other biologically important compounds when present in soap solutions. The authors favour the view that the phenol penetrates the cell membrane by normal diffusional processes, the effect of the phenol/soap complex—the existence of which they consider to be demonstrated by the fact that the minimum interfacial tension of the hexyl resorcinol/soap complex is markedly lower than that of either component—being to increase the effective concentration of the phenol at the biological interface.

These experiments were based on the anthelmintic action of hexyl resorcinol and while, no doubt, the suggestion of general validity may be correct, it has to be remembered that CTAB is not in the conditions of their test, active (*i.e.*, it is not an anthelmintic). On the other hand, CTAB is bactericidal of itself. Iland (*vide supra*) has pointed out that synthetic detergents are often synergistic for other antiseptics. This may well be due to the fact that the complex possibly formed between the antiseptic and the surface-active detergent-disinfectant at the biological interface is in greater concentration than that at which either component would be in the absence of the other. It may well be that this mechanism of complex formation and effect is an essential feature of all drug synergisms.

Preparations of "Dettol" type remain the skin disinfectant *par excellence*. Ritchie and Hamer (*J.S.C.I. Trans.*, 1944) have described a method for the estimation of unchlorinated phenols in chlorinated xylenol mixtures which are the basis of this type of antiseptic. The method depends upon distillation *in vacuo* under standard conditions and the taking of a cut which separates free xylenols, plus some of the monochloro compounds, from the balance of the chloro derivatives. The free xylenols are determined by difference after estimating the chlorine content of the cut. Salle and Guest (*Proc. Soc. Exper. Path. and Med.*, 1944) have found an enhancement of germicidal activity of phenol disinfectants if appropriate metallic salts are added to produce oxidation-reduction systems. The maximum effect is sensitive to the presence of very definite proportions of the components of the system. Zendek *et al.* (*Biochem. J.*, 1943) describe the colorimetric estimation of chlorophenols in the blood by use of a modified Millon's reagent.

Specific Against Pus

Berry has made a further addition to the list of bacteriostatic or bactericidal agents which exert a selective action towards particular organisms. The pus organism, *Ps. pyocyaneus*, is particularly resistant towards penicillin, the sulphonamides, the quaternary ammonium compounds, the aminoacridines, and chloroxylenol. The elimination of this organism is particularly

desirable where skin-grafting is to take place. Berry has found that, in addition to general bactericidal properties, ethyleneglycol monophenyl ether—$C_6H_5O.C_2H_4OH$ (or "phenoxetol" from its alternative description as β-phenoxyethylalcohol)—is specific against *Ps. pyocyaneus*. It is non-toxic and non-irritant to tissues in the concentrations recommended. Its bacteriostatic activity in dilutions lower than those required bactericidally render it a valuable adjunct in admixture with penicillin, sulphonamide, and acridine derivatives. Phenoxetol is a slightly viscous liquid, soluble in water to the extent of 2.5 per cent. by volume at 20°C., the solution having a *p*H of 6.4 to 6.5.

Aminoacridines

The development of the aminoacridine group of antiseptics was briefly outlined by the author last year. Since then Poate (*Lancet*, 1944) has summarised their advantages and disadvantages. Among the former are: activity in presence of serum proteins, very low order of systemic toxicity, non-interference with phagocytosis, compatability with sulphonamides; among the latter are: staining of tissues and textiles, instability of solutions in light, tissue irritation (unless the solution is suitably buffered), absorbability by cotton dressings, necrotic effect on tissues when used in powder form. Poate considers the use of acriflavine (the commercial mixture of proflavine and its methyl chloride) should be discontinued in the light of modern knowledge. It should be replaced by proflavine (2 : 8-diaminoacridine sulphate) which, according to the recommendation of Albert and Gledhill (*Lancet*, 1943; 1944), should first be adjusted to *p*H 6.0 by the addition of sodium bicarbonate. At the same time for particular types of wounds Poate has found 5-aminoacridine (which is virtually non-staining) satisfactory if applied direct to the wound in powder form when mixed with sulphonamides. Russell and Beck (*B.M.J.*, 1944), however, object to the use of proflavine powder in admixture with sulphonamide on histological grounds and prefer the use of proflavine solutions (1 : 1000).

5-Aminoacridine has been the subject of pharmaceutical studies by Falk and Thomas. Ungar and Robinson (*J. Pharmacol. and Exper. Therap.*, 1944), describe a 1 : 1000 solution of 5-aminoacridine in a combined isotonic saline and borate buffer. They point out that the phosphate buffer of the Pharmacopœia is incompatible on account of the insolubility of 5-aminoacridine phosphate.

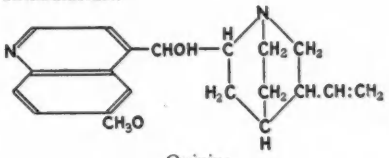
Albert *et al.* (*J.C.S.*, 1943) have compared the distribution coefficients (oil/water) and the tension at the air/water interface with antiseptic properties in the aminoacridine series. They conclude that oleophilic and surface-active properties are undesirable for development of bactericidal efficiency. These same authors (*Lancet*, 1944) have examined the equilibrium between aminoacridines in solution and the amount absorbed by dressings in contact with these solutions. The adsorption complex formed with proflavine and other aminoacridines was found to be of so labile a nature that whether immersed in water or serum the aminoacridine-impregnated gauze acted as a depot for the antiseptic.

Antimalarials

It has been estimated that between 2 and 3 million people die annually as a result of contracting malaria and nearly half these deaths occur in India. The economic loss to the British Empire alone caused by this disease has been assessed at £50 to £60 million per annum. In the present war the malaria casualties in the Sicilian campaign exceeded the total of all those casualties which were a direct consequence of the fighting, while at one period of the New Guinea campaign 80 per cent. of the Allied troops had succumbed to this disease. The scope offered to chemistry and chemotherapy in this field is, therefore, vast.

Quinine preparations have been available since the 17th century for prophylaxis and cure. Many attempts have been made during the last half-century to synthesise the drug, and the final achievement was announced by Woodward and Doering in 1944 (*J.A.C.S.*). The route from the δ-piperidinomethyl derivative of 7-hydroxy-*iso*-quinoline, the starting material, to *d*-quinotoxine from which quinine is prepared by closure of the quinuclidine ring has been described in considerable detail elsewhere (*Chem. Eng. News.*, 1944, *22*, 730; *Pharm. J.*, 1944, *152*, 12; *this Journal*, 1944, *50*, 555).

The synthesis appears to be complex and costly enough to rule out the possibility of industrial application in view of post-war natural quinine production and in the face of present large-scale production of more readily accessible synthetic antimalarials.



Quinine

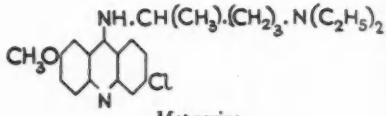
Even without the set-back to natural quinine production caused by the war it is hardly likely that plantations would have been able to meet the increasing world demand for antimalarial agents. Bearing this in mind and also the increased sense of

international responsibility induced by the war, not less in matters of public health than in other spheres, a vast effort to bring the malaria menace under control is likely to develop which will create a great demand for the synthetic antimalarials. Pamaquin and mepacrine are, at present, the chief among these agents and have evolved from the pattern of the antiplasmodial dyestuffs, mainly methylene blue. An outline of the manufacture by Sherndal (*Chem. Eng. News*, 1943) was referred to last year, since then particulars of the route for mepacrine (6-chloro-2-methoxy-9-(δ-diethylamin-α-methylbutylamino)-acridine) have become available in the literature. It is obtained by condensing 6 : 9-dichloro-2-methoxyacridine with 2-amino-5-diethylaminopentane. The former product is obtained by condensing 2 : 4-dichlorobenzoic acid with *p*-anisidine, with subsequent ring closure to yield the substituted acridine. The latter product is obtained from ethylene chlorohydrin and diethylamine as starting materials. These are condensed to β-diethylaminoethanol and, through the corresponding chloro derivative, 5-diethylaminopentan-2-one is obtained, the carbonyl group of which is finally substituted by an amino group. The size of the demand for this product may be assessed from the fact that for prophylactic purposes only four tablets per person per week are required, each tablet containing 0.1 gram mepacrine hydrochloride. The British production is stated to amount to many hundreds of pounds per day.

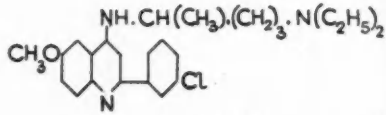
The Future of Mepacrine

In July, 1944 (*Lancet*, 1944, 6325), resolutions were adopted by the U.S. Board of Co-ordination of Malarial Studies and Drug Prophylaxis and the Therapy Committees of the Medical Research Council. It is stressed that mepacrine is no more toxic than quinine and is in certain respects more reliable; but neither quinine nor mepacrine can prevent relapses in vivax malaria. It is stated that mepacrine is not an inferior substitute for quinine and will probably continue to hold its own after the war. Silverman and Evans (*J. Biol. Chem.*, 1944) have found mepacrine to be bacteriostatic towards *B. coli*. The naturally occurring amines, spermine and spermidine, are effective antagonists and it is suggested that mepacrine interferes with their metabolism.

As in the case of other drugs of relatively complex structure a search has been made for simpler chemotherapeutic analogues of mepacrine. Gilman and Spatz (*J.A.C.S.*, 1944) have attempted to correlate constitution with antimalarial action by synthesising quinoline derivatives patterned as "open models" of mepacrine. They found substantial antimalarial activity in 6-methoxy-2-(3′-chlorophenyl)-4-[(α-methyl-δ-diethylaminobutyl)-amino]-quinosine and in the 4′-chlorophenyl isomer. These compounds have a chlorophenyl group in place of the fused chlorobenzene ring in mepacrine. The presence of chlorine was found not to be an essential condition for activity.



Mepacrine



"Open Model"

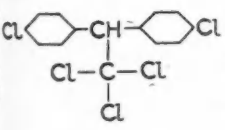
Prophylactic and curative methods alone will be found insufficient for stamping out malaria, and the view has been constantly expressed that the bringing under control of the insect vector will be a more profitable line of approach to the problem. There have recently been developed a number of insect repellents and a most potent insecticide, the availability of which to the forces operating in the Far East is the highest importance. Among the insect repellents in use dimethyl phthalate has wide application. There are also being used by the armed forces preparations based on cyclohexyl caproate, dibutyl-*l*-malate, diethyl-*dl*-malate, benzyl lactate, tetrahydrofurfuryl lactate, and the ethers of diethylene glycol. A number of mixtures have been recently patented and there may be mentioned, by way of example, U.S.P. 2,293,255, which claims a mixture of ethyleneglycol dibenzyl ether and diethyleneglycol butyl benzyl ether or diethyleneglycol monobutyl ether. Another of these repellents, which structurally is in another class, is the butyl ester of 2-carboxy-5-dihydro-6-dimethyl-γ-pyrone, for which great effectiveness is claimed. This latter substance acts insecticidally by paralysing the sensory nerves of the insects' feet while, in addition, it has the unusual and significant property of being an excellent solvent for rotenone.

In the last war attempts were made to control typhus by direct attack on the insect vector by means of sterilisation and fumigation techniques, and both these methods have been used between the two wars in civilian practice. Among the agents available, hydrogen cyanide has had wide application but has obvious dangers and limitations. More recently methyl bromide, methylallyl chloride, trichloracetonitrile,

diphenylamine, bisethylxanthogen, and organic thiocyanates have been used. Such substances suffer various disadvantages in use—skin irritation and odour are commonly occurring objections—but these have been outweighed by their advantages to the extent that preparations based on some of them have had large-scale applications in various parts of the world.

Spectacular results have been obtained during 1944 with a new synthetic insecticide — α : α-bis(parachlorphenyl)-β : β : β-trichlorethane (or dichlordiphenyltrichlorethane and hence " DDT ")—in the direct control of insect vectors. In the malaria field of application control is achieved by spraying an emulsion over infected water wherein the adult insect may be emerging from the larval stage, or by spraying the air of a neighbourhood in which, say, military operations are impending. The insecticide is only effective against the adult mosquito. The most impressive use of DDT to date has, however, been in the control of typhus, the immemorial scourge of armies. The combination of suitable vaccination techniques with the use of DDT should enable this disease to be brought under complete control. The classic instance of its application was the treatment of 73,000 people a day in Naples —1,300,000 were treated in all—leading to the complete control of a potentially dangerous outbreak of typhus.

Dichlordiphenyltrichlorethane, which was first prepared by P. Zeidler in 1874, is now being made in this country, but no particulars regarding manufacture have been published. The Americans have revealed that in the batch process Zeidler's original method is substantially used. This method requires the chorination of alcohol to chloral which is condensed in oleum with monochlorbenzene. There is a continuous process developed by Brothman (*Chem. Met. Eng.*, 1944) by which DDT may be produced at a net cost of $0.30 per lb., which, it is considered, should enable DDT to be marketed at $0.50 per lb. after the war. This compares with a reported cost of $0.85—$1.60 per lb. for the batch process, a cost which is expected to drop to within the range of $0.50-$0.75 per lb. after the war. Raw materials contribute 75 per cent. of this net cost, while steam, water, electricity, and labour contribute 8 per cent., with overheads representing 17 per cent. The capital investment required for a Brothman continuous process producing 200,000 lb. a month is estimated at $211,000 (say £42,000), of which processing equipment for the chloral unit is represented by $27,000 (12.8 per cent.) and that for the DDT units by $28,000 (13.2 per cent.). The War Production Board is said to be aiming at an output of 950 to 1000 tons a month during 1945.



The insecticidal properties of DDT were discovered by the Swiss firm of J. R. Geigy in 1936-37 and its use in suitable form has been protected by that firm in B.P. 547,871 and 547,874 (1939). Pilot plants were established in this country and in U.S.A. in May, 1943, and bulk production began a little later. DDT may be used in the form of suspension, in admixture with an inert dust, or in emulsion after solution in an appropriate solvent.

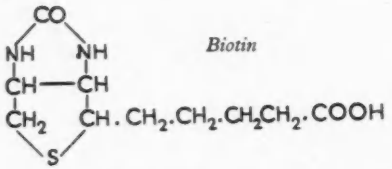
West and Campbell (*Ind. Chem.*, 1944; *this Journal*, 1944, *51*, 245) have reviewed the available preparations and properties of DDT. The spraying of walls and ceilings is certain death to flies and the effect persists up to three months when a ½ per cent. suspension of DDT is used. However, DDT has not the " knock-down " effect of pyrethrum and it has been suggested that preparations will be developed after the war for this purpose, combining DDT with pyrethrum or thiocyanate. It is believed that DDT will have extensive applications in veterinary practice and in the control of horticultural and agricultural pests (*see J. Econ. Ent.*, 1944, *37*, 125). The mode of action of this insecticidal agent is that it causes injury to the whole nervous system of the insect through contact with the sensory organs at the tips of the tarsi (*i.e.*, the " feet "), leading to paralysis and death after a preliminary period of excitation. It may also act as a stomach poison leading to paralysis of the nerves of the digestive tract and of the mandibles.

Scabies Control

The control of scabies has come much to the fore in this country following the war-time dispersal of population. Gordon and Unsworth, in 1943, compared the effect *in vitro* of benzyl benzoate—the most favoured substance for destruction of the causative mite, *Sarcoptes scabiei* var. *hominis*, since it was first introduced for this purpose in 1940—with tetraethyl thiuram monosulphide. Bradshaw (*Lancet*, 1944) has now reported on the clinical examination of this substance in suitable emulsion. He concludes that, with 9 per cent. cures effected over a period of three days at a clinic devoted entirely to the treatment of scabies, tetraethyl thiuram monosulphide is the best sarcopticide.

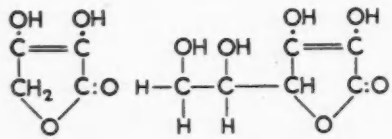
A second (revised) addition of *The Vitamins* (Pharmaceutical Press, London, 1944) affords a useful survey of the subject. F. A. Robinson has contributed an important summary of some recently characterised

components in "The Vitamin B_2 Complex (*Chem. and Ind.*, 1944, 370; 386) which will well repay study. The same author, with Barton-Wright & Emery, describes the detection of a hitherto unknown factor, which stimulates growth in *L. helveticus* and *S. lactis* but not *L. arabinosus*. The substance, as yet uncharacterised, is found in a chloroform-soluble fraction obtained in the preparation of folic acid from liver (*Nature*, 1944). Biotin (Szent-Györgi's vitamin H) has during the past year been synthesised by du Vigneaud and collaborators at the Merck Institute, but details are not available at the time of writing these notes. Biotin consists of a reduced thiophen ring carrying a valeric acid side-chain at the 2-position and fused with a molecule of urea through the 3- and 4-positions to give a second heterocyclic five-membered ring.



Biotin

The effect of biotin on yeast growth is detectable at a dilution of $1 : 10{,}000 \times 10^6$. Du Vigneaud has also reported that β-methylimidazolone-β'-caproic acid could replace biotin so far as *L. casei* is concerned. Wokes *et al.* (*Biochem. J.*, 1943) have discussed the "apparent vitamin C" substances which are liable to be included in estimating vitamin C with dye-titration. These substances have a dienol group and show enol tautomerism. Reduction may be formed when a carbohydrate is treated with alkali and reductic acid may be obtained by the treatment of sugar-beet pectin with mineral acid. It is suggested that hydroxytetronic acid is probably a precursor of ascorbic acid.



Hydroxy-tetronic acid

Ascorbic acid

B.P. 559,302 protects a process for the isolation of *d*-galacturonic acid from a hydrolysate of pectic substances by direct crystallisation in the form of double salts of sodium and calcium.

(To be concluded)

Parliamentary Topics

Steel Manufacture

IN the House of Commons last week Mr. Higgs, who asked the President of the Board of Trade the amount of coal utilised in making one ton of steel in this country and in America, was told by Mr. Peat that the amount of coal required, on the average, to produce a ton of heavy steel is about 2 tons in Great Britain and 1½ tons in the United States, the difference being mainly due to the higher-grade ore available in the United States.

Magnesium Factory

Mr. Burke asked the Minister of Aircraft Production what was the cost to the Government of the M.E.L. factory built in the North-West area for the manufacture of magnesium, now discontinued; how long was production maintained; what interest had I.C.I. in the factory; and what did the Government propose to do with the buildings and the machinery.

The Minister of Aircraft Production: The factory is State-owned, and cost £4,350,000. Production commenced in April, 1943, and was discontinued at the end of 1944. The factory was managed, on an agency basis, by Magnesium Elektron, Ltd., whose shares are partly held by I.C.I., Ltd.; neither company has any direct interest in the factory. Consideration is being given to possible uses for this factory; at present it is being retained on a care and maintenance basis, as stand-by capacity to be used in an emergency.

Butylene glycol—a superior anti-freeze—is being produced by scientists of the Canadian Research Council in a pilot plant on Rideau River, Ottawa; one bushel of wheat yields 10 lb. of butylene glycol and 6 lb. of ethyl alcohol.

Palestine Potash, Ltd., has considerably increased its potash and bromine production during the year, although figures cannot yet be released. The company which, as reported in THE CHEMICAL AGE of December 16, has issued new capital, hopes to engage shortly on the production of magnesium. This, however, will be possible only if the cost of electricity can be reduced, which again depends on the availability of cheap oil. It is reported that the company hopes to solve the problem by finding petroleum locally and, for this purpose, it has founded what is described as the first large oil-exploration concern in Palestine, in partnership with local financial interests. The new venture is called the Jordan Valley Exploration Co., and was registered under Palestinian law a few months ago with an initial capital of £P250,000.

Printed in Great Britain by THE PRESS AT COOMBELANDS, London and Addlestone, and published by BENN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, E.C.4, February 3rd, 1945. Entered as Second Class Matter at the New York, U.S.A., Post Office.